# Bakker et al. (2017) Recent work on the impact of mitigation on the projected decline of the AMOC



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#### Fate of the Atlantic Meridional Overturning Circulation: Strong decline under continued warming and Greenland melting

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## Key points in the introduction

IPCC projects AMOC to weaken but has no Greenland melt

GrIS is losing mass at high rate & will likely worsen

Need GCM ensemble with GrIS melt, uncertainty added

They use emulator for probabilistic uncertainty for AMOC

Aim is (1) to assess impacts of GrIS & mitigation on AMOC

and (2) to estimate the likelihood of future AMOC collapse



#### IPCC model median ~ 15-20% weakening of the AMOC by 2100 under RCP4.5

9-model ensemble with multimodel mean removed



An emulator expands the sample space of GCM runs

Emulator has several key forcing parameters

Emulator is first tuned to each GCM

10 optimal Monte Carlo 'runs' produced for each GCM, using varied forcing parameters

Multimodel mean is removed

Models show varied response to warming RCP4.5 → Median stabilizes to ~ -30% by 2150 RCP8.5 → Median stabilizes to ~ -80% by 2250





#### ← RCP4.5 Median @ -18% by 2100 AD



RCP8.5 → Median @ -37% by 2100 AD Recovery by 2300 AD @ -75%

# RCP4.5 → Impact of GrIS melt <u>minimal</u>



## RCP8.5 → Impact of GrIS melt <u>considerable</u>



### **Results & Conclusions**

- Multi-model mean = 16.5 Sv ; observed = 17.2 Sv
- □ RCP4.5 → AMOC stabilizes in 22<sup>nd</sup> Century, RCP8.5 in 23<sup>rd</sup>
- □ Emulator → Stabilization similar, medians @ -18%, -74%
- □ RCP8.5 → total AMOC collapse 20% probable by 2300 w/o GrIS
- $\Box$  RCP8.5  $\rightarrow$  total AMOC collapse <u>44% probable</u> by 2300 with GrIS
- □ Caution: AMOCMIP neglects solid ice discharge (has melt only)
- □ Antarctic impact is not included

Florida Current (FC) transport has decreased by ~9% since 2005 Sea level at Miami increases in proportion to the FC decrease



### Some key questions for future models

- Does the Florida Current vary proportionally to the AMOC?
- Does this decline presage the AMOC downturn? Or is it decadal?
- How does South Florida sea level respond to FC transport decline?
- What fraction of the recent SLR was due to the Florida Current?